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Proceedings of the 13th Canada/USA Fisheries Discussions

8-10 October 1996

Conference Centre
St. Andrews, New Brunswick
E0G 2X0

Co-Convenors

J.D. Neilson (Canada)
S. Clark (United States of America)

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Abstract

This document provides a record of the discussion following presentations made at the 13th Canada/USA fisheries science meetings held at St. Andrews, New Brunswick, October 8-10, 1996. These informal meetings are held about every two to three years, and are intended to encourage exchange and collaboration between the Canadian and USA federal agencies providing the fisheries science which supports the management of marine resources of common interest.

Résumé

Ce document présente le compte rendu des discussions découlant des exposés présentés aux 13^{e} réunions canado-américaines sur les sciences halieutiques, qui ont eu lieu à St. Andrews (Nouveau-Brunswick), du 8 au 10 octobre 1996. Ces réunions informelles, qui se tiennent tous les deux ou trois ans, visent à favoriser les échanges et la collaboration entre les organismes canadiens et américains voués aux sciences halieutiques et à la gestion des ressources marines d'intérêt commun.

Introduction

The Marine Fish Division (Canada Department of Fisheries and Oceans (DFO), Science Branch) hosted a meeting of United States National Marine Fisheries Service (NMFS) scientists and their DFO counterparts in St. Andrews, 8-10 October 1996. Such meetings occur on a more or less regular basis, are informal in nature, and have been referred to as simply "Canada-US" meetings. By virtue of the informality of these meetings, issues of importance of both countries, such as the management of transboundary resources, can be fully discussed in a scientific venue. In the past, these meetings have usually focussed on fish resources of interest to both countries, but more recent meetings have diversified to include invertebrate resources and marine mammals, to name a few subject areas.

The meeting was well attended, with 43 participants from several disciplines and laboratories. Three theme sessions were included. The first theme session dealt with fisheries input data, and included discussions of commercial fishery sampling, developments in research vessel surveys, and Canadian experiences with joint industry/government initiatives. The latter was of particular interest to USA scientists, as they have had relatively little experience with joint initiatives. Canadian scientists also learned of the difficulties NMFS staff are encountering in converting from a voluntary reporting system based on dealer weighout and vessel interviews at dockside to a mandatory reporting system in which interviews are replaced by vessel logbooks. Such issues are critical for DFO, since Canadian stock assessments of shared transboundary resources rely upon the timely availability of fishery catch statistics from both the USA and Canada.

The second and third theme sessions dealt with transboundary resources in the Gulf of Maine area. Part of the discussion featured presentations on recent stock assessment results for haddock, cod, pollock and herring. The results obtained by Canada and the United States were compared, with a view towards identifying whether differences in assessment results could be attributable to conventions regarding the management unit. Discussions on sharks lobsters and marine mammals were included in the third session. Canadian and US initiatives pertaining to reduction of harbour porpoise bycatch and population estimation were presented. Several possible areas for future collaboration were identified.

Other highlights of the meeting included sessions on social science, in which practitioners from both Canada and the United States discussed the importance of economics and anthropology in the provision of management advice, and sessions on NAFO as a forum for fisheries science and research under the East Coast of North America Strategic Assessment Project (ECNASAP). The meeting concluded with a series of contributed papers dealing with issues such as impacts of bottom trawling on fish habitat, stock assessment methodology, studies on the efficacy of closed areas, bycatch, and egg viability as related to parent size and age.

Theme Session 1 -- Fisheries Input Data: The Present and Future in Both Countries

Commercial Fishery Sampling and Statistics

Presenters: Chris Annand, Greg Power

Rapporteur: Russ Brown

Chris Annand summarized the privately contracted Dockside Monitoring Program (DMP) used to collect commercial fishery data in the Canadian Maritimes. License conditions specify that vessels must report departures and call in prior to landing to arrange to be met by a representative from an approved DMP Company. Hailing information is also available to enforcement agents, who can decide to meet the incoming vessel to monitor unloading for enforcement purposes. A trip record is filled out jointly by the operator and the DMP representative to capture fishing location, gear, and effort information. Trip records are transmitted and keypunched within 72 hours. There were some differences noted between the Gulf and Scotia-Fundy regions in terms of data collection, storage, and accessibility. Matching between dealer landings and vessel trip records is reported to be excellent under this system.

Questions, comments, and discussion focused on several topics including potential collusion between DMP agents and industry, quality of data before dockside monitoring was implemented, enhancement of the biological sampling program, and program costs. Spot checking of DMP agents reduces the potential for collusion. A much greater percentage of total landings appears to be accounted for under the new system than formerly. There appears to have been improvements in biological sampling coverage due to notification of landings and real-time monitoring of trips. Approximately 3,000-4,000 vessels are currently under the DMP; annual costs have been reduced from $6 K to $500 K.

Chris also reported on a scoping exercise conducted in fall 1995 to assess options for biological sampling of commercial landings. Sampling is now coordinated through BIO, and progress is updated electronically on a biweekly basis. Recent reductions in staffing have necessitated supplemental sampling by technical staff from BIO and St. Andrews. DFO is currently exploring the use of the DMP to facilitate biological sampling, but questions remain concerning whether the industry should bear financial responsibility. Funding for the Observer Program is being cut resulting in levies on industry to fund observer coverage. Offshore surveillance is also collecting detailed information on the last haulback during random boardings. Every landing in the herring fishery is sampled for length frequency and many are sampled for detailed biological information including ageing.

Greg Power summarized changes in commercial fishery statistics and biological sampling data collection for the USA, including transfer of data collection responsibilities from the Northeast Fisheries Science Center in Woods Hole, MA, to the Northeast Regional Office in Gloucester, MA. Changes in the summer flounder, multispecies, and sea scallop fishery management plans require mandatory vessel trip reports (logbooks) by operators permitted in these fisheries. There has been basically no change in the dealer reporting system. Beginning in January 1997,

logbooks will also be required for operators involved in the scup, squid-mackerel-butterfish, and black sea bass fisheries. A total of 5,000 vessels are permitted under the summer flounder, multispecies, and scallop fisheries, and an additional 200-300 vessels will be included under the new regulations. Catch data reported through the vessel logbook system was characterized as being of adequate quality, but discard reporting appears inconsistent. To date, considerable difficulty has been experienced with matching dealer and vessel trip records.

Questions, comments, and discussion focused on several topics including the timing of data availability, enforcement, and the vessel buyout program. Complete and audited vessel trip report data for 1994-1996 will be available in early spring 1997, and landings by species stock area for this period will be available by late spring 1997. Mandatory reporting is enforced by monitoring monthly reporting and withholding permits from non-reporting vessels. Permit moratoriums are currently in effect on all fisheries except handlining. The current $25 million vessel buyout program is targeting active vessels, while a new $1 million program will target latent permits.

Joint Industry/Government Initiatives

Presenter: Peter Hurley

Rapporteur: Katherine Sosebee

A presentation was given on joint industry/government initiatives in Canada. These fall into two major groups, surveys and other activities which include interview surveys, cooperative tagging studies, and native bands.

There are currently seven ongoing surveys being conducted by the industry for the government. All surveys require observers so data quality is not a problem; however, standardization between surveys is problematic on occasion. Each project differs as to the actual agreement made between the government and industry. Some involve government funding while others involve a quota allocation.

Questions were raised as to survey origins and anticipated duration. Several surveys were initiated by the government, but others, such as a hydroacoustic survey for herring, were initiated and are funded by industry. Most of the agreements have been informal only and may be broken at any time. The long term agreements arise when industry participation is dependent on receiving a quota allocation. A major concern for these long term projects is the importance of stock size on industry participation. If the stocks rebound, industry may no longer be interested in conducting a given survey. A new fisheries act allows for the continuation of surveys if the industry has a guaranteed share of the quota.

The United States has begun exploring joint projects with industry. The NEFSC Inshore Gulf of Maine survey used location information gathered from Maine fishermen to develop a set of towable stations in inshore areas. There are S-K grants in which spawning areas are being evaluated by industry.

Research Vessel Surveys and Fishery Sampling -- New Developments

Presenters: Paul Kostovick, Joe Hunt, Mike Tork

Rapporteur: Jay Burnett

Paul Kostovick provided a brief review of the NEFSC Bottom Trawl Survey Program, including history, geographical coverage and data collected. The R/V DELAWARE II, which has been undergoing an RTE retrofit, is nearly ready for sea trials. The vessel will be equipped with hydroacoustic (EK500) and SIMRAD trawl mensuration gear when this work is completed. The NEFSC does not standardize trawl tows using trawl mensuration data at present, but will shortly have that capability on the R/V DELAWARE II. The survey program is also exploring options for a data-entry-at-sea system.

Joe Hunt presented an overview of the Scotia-Fundy Survey Program, including its history, evolution and evaluation. Several current and planned activities were outlined, including time series standardization, testing of alternate survey and sampling designs, trawl mensuration, hydroacoustic surveys, real time data entry and evaluations of synopticity and other aspects of survey performance. He encouraged exchange of personnel for survey work and continuation of close ties for survey database access. He also reviewed potential benefits from industry participation in research vessel surveys.

There was considerable discussion concerning implementation of a successful data entry at sea program by Scotia-Fundy personnel. The system uses a series of attribute tables to structure at-sea sampling for a given species.

Mike Tork presented a review of the NEFSC Domestic Sea Sampling Program (DSSP) which is conducted through a contract with the Manomet Observatory. The rationale for sea sampling includes the collection of discard data, detailed effort and gear data, economic data, and the monitoring of protected species impacts. A summary of sea-sampled trips for the period 1989-1995 was presented by fishery. New developments in the DSSP include coverage of the bluefin tuna purse seine fishery and increased coverage of the pelagic longline fishery to evaluate turtle takes.

A question was raised as to whether or not DSSP observers had any enforcement role (they do not). Discussion centered on the use of DSSP data in U.S. stock assessments. Discard estimates from DSSP data have been incorporated into analytical assessments for flatfish (American plaice, witch flounder, yellowtail flounder and summer flounder), but not for other groundfish. NMFS is currently developing a more rigorous sampling design for the DSSP.

Theme Session II -- Distribution and Migration of Transboundary Resources in the Gulf of Maine Area: Areas for Joint Investigation -- Co-Convenors: S. Gavaris(Canada) and S. Murawski (USA)

Haddock (R. Brown, S. Gavaris)

Comparison of the USA assessment for NAFO Subdivision 5Ze with the Canadian assessment of the NAFO 5Zj,m management unit suggested that after 1985, biomass and recruitment came primarily from 5Zj,m whereas previously there had been about an equal contribution from the Northeast Peak and Great South Channel spawning components. A presentation on relative abundance and migration on eastern Georges Bank in relation to the international maritime boundary described an eastward summer migration towards the Canadian side and a westward return migration into USA waters in winter probably associated with spawning behavior. The distribution pattern from 1963-71 was identified as potentially anomalous due to exceptional recruitment from the Great South Channel spawning component and resultant unusually high abundance.

It was suggested that pre-1963 survey data could be used to compare distribution with recent patterns. Further, historical data could be used to examine the relative contribution from the North-east Peak and the Great South Channel spawning component by reconstructing the population dynamics on a finer spatial scale. New technology useful for stock identification could be also applied to archived hard parts. There is a need to investigate rebuilding strategies other than $F_{0.1}$ and the effect of this strategy on the two Georges Bank spawning components, which may be exploited differentially. Research on the effects of physical parameters, such as circulation patterns, on recruitment was also considered to be potentially useful.

Ichthyoplankton data collected under the US GLOBEC program may provide information relevant to stock structure and management issues. Distributions of cod and haddock eggs on Georges Bank and patterns in retention times as simulated by modeling experiments were consistent with prevailing notions of comparative stock structure between these two species. Stage 1 cod egg abundance is inferred from Stage 3 eggs, and feedback on this approach was requested. The largest proportion of Stage 1 cod eggs are found during March-April. Particle residence time is high during this spawning time. Haddock eggs are being found to have a 30-40 day residence time, and this should be similar for cod eggs. Residence time was defined as a particle still present on the Bank after an arbitrary period. Questions on depth or survivability were clarified. The survey uses depth-integrated tows, so buoyancy differences should not affect the data. Lack of survival estimates might be a concern, however.

Cod (J. Hunt, L. O'Brien, W. Stobo, M. Buzeta)

A comparison of the USA assessment for the NAFO Div. 5Z and 6 and the Canadian assessment for 5Zj,m management area indicated that trends in biomass, recruitment and exploitation were consistent in both assessments, giving no indication of differential dynamics in the two areas .

Preliminary results from cod tagging experiments on Georges Bank, the Bay of Fundy and Browns Bank were presented. Most of the cod tagged were mature. In one analysis, results were weighted by effort. The majority of recaptures are from the division of release, but there is some exchange of fish between Divisions 4X and 5Z. More fish move from Georges Bank to Brown's Bank than vice versa. Few fish released on the Canadian side of Georges Bank were recovered on the USA side. There seems to have been little change over time on observed distribution patterns. Another analysis focused on seasonal movements between Georges Bank and 4X across the Fundian channel. From releases on Georges Bank early in the year, there were recoveries from both Georges Bank and Brown's Bank until the fall when a shift in recoveries occurred back towards Georges Bank. From releases on Brown's Bank early in the year, recaptures show an initial movement to Bay of Fundy and inshore areas followed by movement to Gulf of Maine and Georges Bank. By late fall-early winter cod begin to retreat back to Brown's Bank, although some remained on Georges Bank.

It was suggested that hydrographic conditions may affect movement across the Fundian Channel as there is greater water circulation in some years than others. The implications of migration on assessment results could be examined with a simulation study. Tagging results should be supplemented with other information, such as work on otoliths. It was noted that the area closures in the USA might affect results, and that there may be tagging data available from before these measures were implemented.

Work in progress on otolith characteristics of 5Zj,m cod samples, typing otoliths according to the pattern and sizes of annuli was presented. The most common Georges Bank otolith growth pattern indicates fast summer growth between the first and second annuli and such otoliths are coded as Type Z. The less common otoliths depicting slow, regular growth were seen in 12% of the population, and were coded as Type Q. Type Q type fish were last seen in 5Zj,m with the 1990 year class. One possibility is that Type Q fish are immigrants from a nearby population, and lengths at age between type Q cod and Scotian Shelf cod are consistent. Other possibilities still need to be explored, such as migration from other areas, hydrographic events, or a slower growing group of cod within the Georges Bank population. USA samples from Division 5Y have been offered and will be examined. Possible links to a hydrographic event in the early 1990's will also be investigated. Suggestions for further work included looking at maturities, including the 1995-96 data, and extending the data back into samples prior to 1992.

Pollock (J. Neilson)

The USA management unit consists of NAFO Divisions 4VWX, and Subareas 5 and 6. Options for management units employed by the United States were reviewed at SAW 9, where it was concluded that future USA assessments should continue to use this unit to minimize impact of possible immigration or emigration of pollock across the international boundary on estimates of F. Canada uses a subset of the USA management unit, which includes NAFO Divisions 4VWX and 5Zc.

Results of the two most recent assessments conducted by Canada and the United States were compared, including trends in fishing mortality, recruitment, and adult biomass. In general, the

trends showed good concurrence. A notable exception was the interpretation of the most recent strong year class, which Canada has interpreted as 1989 but USA scientists consider to be 1988. It was suggested that an exchange of otoliths could resolve this issue. As well, ichthyoplankton distributions, tagging data and growth rate information were presented and summarized.

It was concluded that the choice of the management unit does not appear to impact assessment results. The choice of a large management unit (4VWX+SA5) is supported by the movement of juvenile pollock tagged in western 4X across the international boundary. However, fish tagged on the eastern Scotian Shelf show no tendency to cross the boundary, and their growth rates appear slower than fish occurring on the western Scotian Shelf and Bay of Fundy. Also, differences were found in morphometric and meristic studies. The possibility of more than one stock occurring within the management unit could not be dismissed.

Apart from the otolith exchange recommended earlier, a further recommendation was to complete the analyses of the tagging information including adjusting for the probability of recapture.

Mackerel (S. Murawski)

Current landings of mackerel are low relative to past reports with F=0.02-0.03 and a CV of about 60%. The imprecision of assessment results is a reflection of low exploitation and a relatively inactive fishery. Biomass is high, in the order of 2 million metric tonnes and recruitment is strong. Currently there is a good exchange of data between Canada and the United States. However, more information is needed on the seasonal distribution and migration of the species. Joint assessments would benefit both countries and the potential for hydroacoustic surveys should be investigated.

Illex Squid (S. Murawski)

There have been a number of improvements in the assessment of this species in recent years. Currently a dynamic surplus model is being used with a target F=50%. Given the short life of this species and the potential impacts of overexploitation, real time management is being recommended. There is a need to develop new approaches to the assessment, trawl survey timing needs to be examined for appropriateness (too late or too early?), life history information should be incorporated into the advice, and databases need to be integrated to obtain an overview, especially given the recovery of the stock in NAFO Subareas 2-4.

Herring (S. Murawski, R. Stephenson, G. Melvin)

Herring landings for the coastal stock complex (including 5Y, 5Z and 6) are low (F=0.02) relative to the estimated 2-4 million tonnes of SSB, however some concern is being expressed about specific components of the complex. In particular, coastal Maine fishermen are finding it difficult to find fish. Furthermore, although record high SSB's are being estimated the VPA does not converge well and CV's are high. The need for assessment of the individual components is now being recognized. The low precision of the assessment is of concern. More work is need on

the individual stock components and indices of abundance. Stock ID methodologies need to be examined and estimates of the contribution of major spawning components such as Georges Bank and Nantucket Shoals are required.

Subsequent discussions focused on the Georges Bank component. Information was presented on the current issues relating to the recovery of this transboundary stock and anticipated increases in fishing effort. Currently, Canada and USA assessments and advice differ significantly. Canada assesses Division 5Z only, whereas the USA uses a pooled VPA for the coastal stock complex. Both Canadian and USA industries, which are working together, are finding it difficult to accept these differences and both are now asking for further research to address their concerns. Research priorities identified by the Canada/USA Industry/Science/Management Working Group include a synoptic larval survey, a coordinated tagging program, evaluation of acoustic survey possibilities, and a scientific workshop to resolve the differences.

It was also noted that there is a move toward management of individual spawning components with the NAFO Div. 4WX management unit. This initiative is intended to prevent the overexploitation of spawning groups within that complex .

A review of historical migration and distribution patterns observed for Georges Bank herring and their consistency with recent survey data was presented. Basically adult herring on Georges Bank are observed where expected.. Larval distributions have varied during the early stages of the recovery, but have returned to historical patterns. Virtually no information is available concerning the distribution or movement of juveniles from the Bank.

Although assessment results differ, there are several consistencies. These include a major recovery beginning about 1983, a consistent pattern of rebuilding of historical spawning beds, and the first report of spawning on the Canadian side of the Bank in 1992. The main difference is the extent of the recovery and the estimated SSB which can be attributed to different assessment approaches. Canadian advice is based on biological characteristics and available index trends, while the USA apportions Georges Bank from the SSB for the entire Gulf of Maine. The driving force behind the record high SSB level are the Georges Bank and Nantucket Shoals spawning components, the latter of which is not included in the Canadian assessment.

A discrepancy in the age distribution of herring being observed on the Bank was also reported, where only one year out of 8 showed a similar pattern in Canadian and USA surveys. Virtually no fish over the age of 6 were found in the US database.

Several questions were raised regarding the appropriateness of a bottom trawl survey as a tuning index for a pelagic species. Recent observations show a major change in catchability which can not be accounted for by vessel and gear differences. Furthermore, the use of the spring bottom trawl index does not permit assessment of individual spawning components. The fish are mixed at this time of year and are more a reflection of the complex than any one component. Also based on the available data, age classes can not be followed from year to year. The problem is further complicated by termination of both the US larval survey (Jan 1995) and the Canadian larval survey (Nov 1995).

Both countries recognized the need for more consistent advice for Georges Bank. Recommendations include further evaluation of the bottom trawl survey data, methods for improving assessments, additional work on stock ID, hydroacoustic survey potential, and an exchange of otoliths for age comparison.

(Convenors' Note): A general discussion following all the presentations focused on the information gaps and on opportunities for co-operative studies. Major points and recommendations are summarized below.

Illex Squid : New assessment methods should be explored taking into consideration life history characteristics and their impact on management advice. The USA assessment currently considers only that portion of the resource in USA waters. The recovery in Subareas 3 and 4 may make it profitable to pursue research and assessment on a joint basis, perhaps through NAFO. Survey and fishery statistics could be integrated and shared.

Mackerel : Mixing of the north and south components is poorly understood as is the influence of environmental factors on distribution and availability.. Collaborative research should be aimed at these topics. Co-ordinated periodic egg/larval surveys could be conducted to evaluate the relative strengths of the two spawning components.

Herring : There is a need to understand and resolve inconsistencies between USA and Canadian advice on stock status. Further, the advice should identify the relative contribution of different components. Both USA and Canadian larval surveys have been discontinued, therefore collaborative studies should focus on identification of reliable indices of abundance from other sources. Exchange of ageing material should be initiated to promote consistency in interpretation. Utilization of fishery information from the outset of any developing fisheries should be enhanced to take advantage of opportunities to improve our knowledge of herring biology.

Haddock : It was agreed that there should be joint studies to determine the relative contribution to production by the two spawning components on Georges Bank from historical records. The potential of emerging stock discrimination technologies could also be examined. The implications of spatial structure to the stock rebuilding strategies could also be considered.

Pollock : The evidence suggests that pollock in Divs. 4VWX+ SA 5 include a complex of stocks; the potential benefits of explicitly recognizing discontinuities such as the 4VW/4X boundary or northwestern Bay of Fundy/southeastern Bay of Fundy should be investigated. Tagging of juvenile pollock in the coastal areas of Maine could enhance understanding of migration patterns. Exchange of ageing material should be initiated to promote consistency in interpretation.

Cod : Studies should be aimed at investigating implications of the degree of movement and mixing indicated from available data to stock status advice. A full evaluation of impacts should consider cod in Divs 4X and 5Y as well as Division 5Z. Examination of tagging returns from the New Brunswick side of the Bay of Fundy may reveal interesting affinities. The preliminary work

with otolith typing for eastern Georges Bank cod looks promising and could be extended to other areas in the Gulf of Maine.

Other Species : Scientists in both USA and Canada are being challenged to provide advice for "non-traditional" species for which much less is known. A sharing of information and common review of evidence regarding biology and distribution should facilitate the formulation of rational advice.

Review of Social Sciences Research Programs within DFO and NMFS

Presenters: Trish Clay, Eric Thunberg, Leo Brander

Rapporteur: Sue Wigley

USA policy now mandates the inclusion of socio-economic information within all fishery management plans (FMPs). This is a change from the past, when all FMPs contained benefit-cost analyses, but only some contained social impact assessments. Presently, social science analyses are entering the management process at the evaluation phase. With NOAA's commitment to build sustainable fisheries, the need for collection and incorporation of social and economic information throughout the management process (planning, implementation, and evaluation) is recognized.

The Social Sciences Branch within the Northeast Fisheries Science Center (NEFSC) is currently involved in incorporating such information into the Northeast Multispecies, Sea Scallop, Lobster, Summer flounder, Goosefish, and Squid-Butterfish-Mackerel FMPs. The Branch provides information and/or analyses on bio-economic aspects of stock/fishery interactions, ex-vessel landings and revenues, vessel economics and finance, processing and shoreside activities, consumer demand (price analysis), international trade, recreation values of living marine resources and social and cultural analyses of behavior both aboard vessels and shoreside in fishing communities.

Some on-going NEFSC economic research programs and activities include: 1) price analysis-methodology and statistical properties of estimators; 2) property rights- quotas; 3) vessel economics and finance: vessel buyout and permit buyout; 4) bio-economic modeling, fleet behavior, groundfish closure areas, and growth overfishing, and 5) regional economics in relation to Amendment 7. Current anthropological studies include: 1) a sociocultural inventory of the Northeast groundfish fishery; 2) subsistence use of marine organisms in Massachusetts; 3) relative effects of limited access and days-at-sea regulations on large versus small vessels; 4) changing fishing and household patterns in the gillnet fishery in response to area closures, and 5) differing fishermen views of limited access based on the use of quotas versus territories, and the relationship of these to fishermens' views on individual versus community ownership.

Canada has no legislative requirements to incorporate socio-economic information into its fishery management process. Social aspects of fisheries are not handled within DFO, but are contained within the Human Resources Department (HRD). Canadian DFO economists focus on

FMP related issues such as partnerships, co-management, ITQ/IQ, dockside monitoring programs and fisheries of the future, and round table discussions of multi-species licences.

Discussions suggested that one possible opportunity for joint research might focus on a bioeconomic model of the haddock fishery on Georges Bank. Canadian scientists felt that there should be more regulatory flexibility and that there was movement away from ITQs towards co-management. Discussions touched upon the role of social and economic research, and it was noted that, as co-management evolves, the need for socio-economic information will increase.

NAFO as a Forum for Fisheries Science

Presenter: Bruce Atkinson

Rapporteur: Loretta O'Brien

Bruce Atkinson presented a short history of ICNAF and NAFO and reviewed the current structure of NAFO, including responsibilities of the standing committees and avenues and procedures for generation and transmission of scientific advice. The Scientific Council, through its Standing Committee on Fisheries Science (STACFIS), is responsible for preparation and review of assessments and provision of advice to the NAFO Fisheries Commission. Member nations may request advice for stocks lying wholly outside their jurisdiction, or partially or entirely within their regulatory areas.

As the USA is now a member of NAFO, the Council could provide a forum for joint assessment of transboundary stocks (for example, Illex squid) of interest to the USA. Benefits would include third party peer review and singular advice to the respective countries. A joint assessment would only come about, however, if requested by both coastal states within whose boundaries the stock resides. The Council may also provide a forum for cooperative efforts to develop new methods e.g. precautionary advice and techniques. It was noted that the concept of transboundary assessment and management of stocks can also be extended to marine mammals. There is currently no forum available for formal discussion of marine mammal transboundary issues in the Northwest Atlantic since the member states of NAFO are not all members of IWC.

NAFO may also be a forum that could subsume the Canada-USA Scientific Discussions in some way; or these Discussions could be held prior to the June Scientific Council meeting or the September annual meeting. This view was supported for the practical aspect of eliminating travel time for people scheduled to attend both meetings. Historically, Canadian and USA scientists used to meet prior to the ICNAF meetings to discuss assessment results.

Participation in NAFO meetings is currently restricted to government organizations from the respective member nations. The question was raised regarding the possibility of industry participation, as is done in the Canadian Regional Assessment Process. Bruce noted that the issue of 'transparency', which allows participation by non-governmental observers, is now being discussed within NAFO.

There was concern voiced about the Scientific Council meeting being held at the Annual Meeting concurrent with the Commission meeting. (The resultant "on-call" status of scientists may lead to inefficiency and unrealistic requests for advice.) It was noted that although there can be a certain amount of political pressure in the meeting , having the SC available to convene if the Fisheries Commission needs information forestalls a delay of 12-18 months, since the Fisheries Commission usually only meets once a year.

It was recommended that a working group be formed to determine how the scientific utility of NAFO might be improved, and to consider the future of Canada-USA Scientific Discussions within this context.

Theme Session III -- Distribution and Migration of Transboundary Resources in the Gulf of Maine Area: Areas for Joint Investigation - Cont'd Co-Convenors: E. Trippel (Canada) and D. Potter (USA)

USA and Canadian Stock Assessment Approaches for Lobsters in the Gulf of Maine

Presenters: Paul Rago and D. Pezzack

Paul Rago summarized the most recent US assessment for American lobsters (SARC 22) including calculations of mortality based on a two-staged DeLury analysis and a size-based VPA approach. In addition, other metrics of the health of the resource were presented, including the underlying size composition of the population and the landings (by sex); the proportion of landings within one molt of the minimum legal size; size-specific contribution to egg production, and effort and CPUE trends. The calculated mortality rates, when used as inputs to an updated egg production/yield per recruit model, generated size compositions in agreement with commercial sampling data.

It was noted that cooperative studies have greatly improved analytical capabilities for Gulf of Maine lobsters by filling in gaps in size composition data and growth and maturity information. This information was obtained through current and ongoing co-operative studies through both the SARC process and a DFO based project, the Canadian Lobster Atlantic Wide Study (CLAWS). These studies have been extremely useful in providing information and analyses that are difficult or costly to obtain or require collaboration and/or validation. Options for a joint assessment for the Gulf of Maine portion of the lobster resource should be addressed in the near future.

Douglas Pezzack summarized the present state of lobster assessments in the Canadian portion of the Gulf of Maine area. Here there have been no formal lobster assessments or development of standardized assessment methods. The first assessment for the SW Nova Scotia region is planned for the Oct. 1996 RAP and an expanded assessment including the offshore and Bay of Fundy is planned for 1997. These will be based on landing trends and size composition data from sea sampling, calculations of fishing mortality based on size-based methods, C/E information from voluntary logbooks and trends in NMFS bottom trawl survey indices. Data availability problems at present preclude a two-stage DeLury analysis. Egg per recruit estimates

for the various fisheries have been calculated. The goal for the next two years is to improve the assessment methodology and apply it to all areas.

The CLAWS project aims at improving assessment and understanding of the lobster fishery and stock dynamics. The project includes working groups on assessment methodology, catchability, growth and reproduction and juvenile and larval ecology. USA scientists are participating.

Marine Mammal Investigations

Presenters: D.Potter, E. Trippel, D. Palka

Dave Potter summarized USA legislation for marine mammal protection i.e. Marine Mammal Protection Act of 1972 and Endangered Species Act of 1990. Stock assessment research activities by the Protected Species Branch of NEFSC include the estimation of bycatch and abundance, bycatch mitigation and life history studies.

Methods of abundance estimation from line transect surveys were outlined, together with methods used to estimate bycatch (harbour porpoise). The effectiveness of acoustic pingers in mitigating bycatch in U.S. waters was also reviewed. Other projects concerning the life history of harbour porpoise included the determination of seasonal and spatial movements (tracking with satellite tags), and feeding and necropsy studies. Projects done in affiliation with other agencies such as the New England Aquarium include stock ID studies, determining methods of reducing mortalities from ship collisions, and cataloging right and humpback whale populations from photo ID. USA scientists also participate in the IWC and ICES in a number of capacities e.g. IWC revised management procedures. More recently work in support of take reduction teams formed to reduce bycatch of strategic stocks to potential biological removal (PBR) levels has occupied a significant amount of time.

Debra Palka described line transect survey methodology used to determine the abundance of the Gulf of Maine/Bay of Fundy stock of harbor porpoise. Ship and airplane abundance results were also compared to determine the probability of missing harbor porpoise during aerial surveys and the variability of results from aerial surveys. Abundance was determined by the direct duplicate method. Based on data for the 1991, 1992, and 1995 surveys the inverse variance weighted-average estimate of population size for this stock was 54,300 (CV=14%), resulting in a PBR of 483.

Bycatch estimates are determined from observer data and commercial fishing effort data. The estimated annual average fishery-related mortality to this stock in USA waters during 1990-1995 was 1,834 porpoise (CV=0.12), not including mortality in the USA mid-Atlantic fisheries.

Ed Trippel reviewed Canadian efforts to evaluate and mitigate bycatch of harbour porpoise in gillnets in the lower Bay of Fundy since 1993. The use of acoustic pingers has been effective, allowing the groundfish gillnet fishery to remain open. Two regions near Grand Manan Island, the Wolves Isles and the Swallowtail region, account for most of the bycatch.

In 1995 the bycatch rates of ensonified (with pingers) and control gear were compared to evaluate pinger effectiveness, and esonified gear demonstrated 0.016 mortalities per string, as compared to 0.085 mortalities per string for controls. The total Canadian bycatch was estimated to be 87 for 1995. It was estimated that bycatch could have been over 300 if pingers had not been employed. The current conservation strategy will allow a bycatch of no greater than 110 porpoise before a fishery closure is initiated.

The status of harbour seals in the Bay of Fundy was reviewed by Wayne Stobo. Five yearly helicopter surveys of the Bay of Fundy have revealed that 80 % of harbour seals are found on the New Brunswick side of the bay. As this population is considered to be closely assosiated with the Gulf of Maine population, it would be beneficial if a joint Canada/U.S. survey be conducted.

In the ensuing discussions, participants recommended that researchers in both countries should (a) keep their counterparts informed as to research plans and developments and (b) cooperate fully on research projects of mutual interest, particularly involving harbour seals and harbour porpoise. Other points raised included the following:

1. Harbour and grey seal populations are increasing rapidly and should be monitored more closely. Problems include losses from attacks on salmonid aquaculture cages. Shooting seals is illegal under the revised (USA) MMPA and may not be a viable solution politically in Canada; use of acoustic deterrent devices on cages and weirs may impact on cetacean habitat.

2. The potential biological removal or PBR statistic may be too conservative e.g. harbour porpoise populations appear to be stable even though the US bycatch was over 3X PBR. However, if abundance estimates are inflated from including Gulf of St. Lawrence animals (as suggested by a 50% increases in abundance estimates in one estimate), then PBR might be too high. This is difficult to resolve until more information is available on stock structure.

3. There is uncertainty relative to the effectiveness of acoustic pingers, e.g. in one USA 1994 experiment herring catch was lower in ensonified gear. This suggests that herring react to pingers, and that lower porpoise bycatch in such situations might reflect herring avoidance. If this scenerio is correct, pingers may impact on herring weir catches- a concern expressed by herring weir fishers. For seals, these devices may act as "dinner bells" rather than deterrents.

4. For harbor porpoise, Canada and the USA use different methods of determining bycatch limits, but this does not appear to be a problem. Canada uses 4% of the largest population number estimate as a bycatch limit, whereas the USA is using the PBR of 483. PBR can be achieved if Canadian bycatch remains below 100, and USA bycatch below 400 mortalities.

5. It is not yet known if an observer program will be initiated for Canada in 1997. It is hoped that the entire fleet will employ ensonified gear if the pingers can be purchased. It would be valuable to monitor the results of such an endeavour, but observer coverage may be less than 50%.

Canadian and USA Investigations on Sharks

Presenters: N. Kohler, L. Natanson, P. Hurley

Rapporteur: P. Hurley

Nancy Kohler of NMFS gave an overview of the Apex Predator Program at the Narragansett Laboratory. Areas of research focus include studies on migration and distribution, age and growth, reproductive history and location of nursery grounds, food chain dynamics, and longline vessel surveys. She then summarized the work on migration and distribution. Since 1962, the lab has been involved in an extensive co-operative tagging program with fishers. Over 6500 participants are involved with 125,000 sharks tagged and 6,000 recovered. She pointed out that the blue shark recoveries indicate an Atlantic population. Similar results were reported for shortfin mako, although these sharks are not as extensively distributed as blue sharks. The 60 or so porbeagle recoveries suggest a Northwest Atlantic population.

A short description of the management plan was given. This plan differentiates between large coastal, small coastal and pelagic sharks. Many of the regulations are similar to the Canadian plan, except for limited access which is a future possibility.

Lisa Natanson gave a report on a study of porbeagle reproduction, age and growth initiated by the Apex Predator Program. Samples were obtained from two trips (fall 1993 and spring 1994) on a Canadian longliner. The sex, size and number of embryos from about 300 females have been enumerated. Vertebrae were obtained from a number of specimens for age determination. In September 1996, during an international research charter, 15 porbeagle sharks were injected with tetracycline and tagged and released, for age validation purposes.

Peter Hurley of DFO gave an overview of shark research and management activities at BIO. The program has limited resources and has so far focused on the analysis of existing data and support for management plan development and initiation of cooperative tagging program. In the spring of 1996, an elasmobranch team was struck to compile existing information into assessments for porbeagle, blue and shortfin mako sharks. A product of this process was the generation of 14 research recommendations for further work. It was noted that many of these would profit from Canada/USA collaboration and with this in mind, he and Nancy had developed a joint research plan for porbeagle which Peter then presented to the group.

The main elements of the plan included studies on:

- Distribution and migration: It is planned to combine the US and Canadian fisheries observer and tagging program data sets to allow description of the temporal and spatial distribution and movements of porbeagle sharks. This will include an examination of changes in the sex/size composition of catches in the porbeagle fishery from Canadian observer data. Collection of further materials for DNA analysis is also planned.

- Age and growth: The current work on vertebral aging will continue and will be augmented by modal analysis of the length composition data from Canadian fisheries observers. It is hoped that recapture of the tetracycline-injected sharks will provide age validation. If necessary, further material will be collected by Canadian observers in the coming year.

- Reproduction: The analysis of existing material/data will hopefully elucidate the reproductive cycle of the porbeagle. If necessary, further material will be collected by Canadian observers in the coming year.

- Population Modeling: A demographic model will be used to describe porbeagle population dynamics.

- Catch Rate Analysis: An analysis of porbeagle catch/effort data from the Canadian fisheries observer program will be undertaken to develop indices of abundance.

- Landings data: The historical data set is inconsistent between sources and even within sources. An attempt will be made to identify primary sources and rectify the historical record.

Overall, an ambitious but realistic plan was presented.

In the following discussion, questions were asked on the existence of food habits data. It was replied that data for 7 - 8 species has been computerized and is ready for analysis. There were comments raised on the need to study elasmobranch resilience to harvesting. Work on biological targets has so far focused on spiny dogfish, and is documented in the SARC series. Nancy mentioned that as a precautionary measure, the US is contemplating a 50% reduction in quotas for the large coastal shark group.

Discusssion of the ECNASAP Project

Presenter: Bob O'Boyle

Rapporteur: Steve Clark

Bob O'Boyle reviewed results of a cooperative study by scientists working under the East Coast of North America (ECNASAP) Strategic Assessment Project (USA, NOAA SEA Division) and the Canadian Cod Mortality Project (DFO, Dartmouth and St. John's). This work has been directed towards identification of species assemblages and distributional changes from Cape Chidley to Cape Hatteras. A workshop was held in Woods Hole, MA July 10-11, 1996 involving many of the participants in the current meeting. The workshop reviewed progress on species assemblage/association analyses, single species distribution dynamics studies and other topics, including reviews of related research conducted by Woods Hole staff. The reader is referred to the report of that workshop (Anon 1996), available from Woods Hole, for additional details.

The review identified high priority research needs including: data rescue (historical survey and environmental data); additional life history information; analyses to evaluate sampling bias and data reliability; habitat preference analyses and development of relevant analytical tools; and modeling to determine effects of physical and biological factors on distribution.

Participants noted the importance of continuing such efforts, limited resources notwithstanding. USA participants expressed the willingness to commit more resources to rescue of historical data sets.

Reference

Anon. 1996. Proceedings, ECNASAP Workshop. Unpublished Report, Woods Hole, MA, 12p.

Theme Session IV -- Contributed Papers (Co-Convenors, R. Brown (USA) and G. Melvin (Canada)

1. Causes of the retrospective pattern in stock assessments (R. Mohn)

Successive assessments for several stocks have indicated consistent under or over estimates. This has been referred to as the retrospective pattern. A stock assessment provides two views of population abundance, one being the VPA estimate based on catch data and the other being trends from abundance indices (survey or commercial CPUE). These two views are related through a catchability function, "q", typically assumed to be stationary. The retrospective pattern may arise when q is not stationary. Application of a "q correction" technique where the q in each year is adjusted relative to a reference q, allows the computation of q corrected numbers at age and two fishing mortality histories, one based on catch and the other based on abundance indices. Simulations indicate that comparison of these histories and associated population abundances offer an effective diagnostic for detecting non-stationarity in the catchability function. This may result from discarding, changes in natural mortality, or changes in partial recruitment to the fishery or in survey vessel catchability. Distinguishing between some of these causes may not be possible with real data using available diagnostics, and ancillary sources of information would be needed. If the cause can be ascertained, then an appropriate "q correction" can be prescribed to remedy the situation. It was noted that some non-stationarity causes could be addressed a-priori, e.g. weighting by sampling error for "spiky" variability, but such approaches alone have not always eliminated the retrospective pattern.

2. Egg viability and offspring production in young Atlantic cod : implications for stock recruitment relationships (E. Trippel)

Initial investigation indicated that sperm viability was not affected by parental age and so attention has focused on egg viability. Laboratory studies permit observation of the entire batch spawning process which can require over 50 days and also allow follow-up study of individuals. Results demonstrated that fertilization and hatching rates were lower for first time spawners compared to second time and older cod. Further, the size of larvae at hatching were smaller for first time spawners. Larger fish are known to spawn over a longer period than first time

spawners. Three factors- fecundity, egg quality and duration of spawning- are important characteristics affecting spawning stock/recruitment relationships, but have not been explicitly accounted for. Management measures focusing on conserving small fish have resulted in increased fishing mortality on older fish; but because of complex, and as yet incompletely understood recruitment dynamics, management measures should aim to moderate fishing mortality at all sizes/ages. It was suggested that historical ichthyoplankton collections or otolith collections could be examined to reconstruct reproductive patterns in the past. It was observed that partitioning of the spawning stock into categories such as "first time", "experienced", "superior", etc. may provide the basis for improved stock/recruit relationships. This has been attempted for striped bass.

3. Trawling Impact Studies (C. Bourbonnais)

An experimental site was chosen on the Grand Banks to study the effects of trawling. Commercial fishing was not permitted in the area. Research survey trawling was conducted adjacent to control corridors where no trawling was allowed. The corridors were sampled and video taped before and after treatment. Preliminary results indicate increased physical damage to organisms and reduced biomass in the trawled corridor. Some follow-up is planned to monitor recovery. Video tapes taken from a submersible during a juvenile gadoid survival study on Georges Bank were offered for comparison.

4. Utility of Biological Reference Points (A. Sinclair)

Alan presented an overview of some of the reference points such as F_{msy}, F_{max}, F_{med}, SSB/r and their derivation. Application of these reference points to the Gulf of St. Lawrence cod stock and the influence of changes in weight at age was demonstrated and showed that in some cases there was inconsistency. For example F_{msy} could exceed F_{max}. The group noted the need to better define SSB as a measure of effective spawning/recruitment success given changes in stock maturation rates and age structure.

5. Discarding Studies in the USA Otter Trawl Fishery (S. Murawski)

Steve presented results of a GLM analysis of sea sampling data to evaluate factors influencing discard rates in the USA otter trawl fishery. Factors such as main species sought, mesh size, tow duration, species composition, depth, etc. were evaluated; results showed that mesh size and species sought accounted for much of the discard. The group noted that interactions between variables and missing cells could impact on interpretations. As well, the non-enforcement role of the observers probably gave a realistic picture of 'typical' fishing operations.

6. Closed Areas (P.Rago, R. Brown)

Paul Rago (NEFSC) presented a model for development and evaluation of closed areas as a fisheries management tool. Key variables included in the model were:

1) area size and shape;

2) ratio of closed area vs. open area;

3) location of the area in relation to abundance and fishing effort;

4) relocation of fishing effort due to closure; and

5) the rate of movement of fish in and out of the closed area.

An analysis of the Nantucket Lightship Closed Area to protect yellowtail flounder was presented as an example. The primary variable was the rate of movement or transport rate of fish in and out of the area; and evaluations of the effectiveness of such measures are obviously dependent on the accuracy with which such movements can be measured. Assessment of potential interactions with other management tools is necessary to accurately assess the effectiveness of closed areas.

A question was raised as to how best to formulate guidelines for defining closed areas. For maximum effectiveness, such areas should be made as large as politically feasible, incorporating information on migration, seasonal changes in distribution in relation to depth and other variables. Canadian participants noted problems DFO has experienced with implementing closed areas as effective management tools. NEFSC Social Science Branch staff members have been active in economic analyses of the impacts of closed areas and some of the methodology may be useful in biological studies.

Russell Brown presented an analysis of haddock distribution patterns in and around Closed Areas I and II and the Nantucket Lightship. He also discussed some of the problems associated with such analyses. These areas have been in existence for some time, but until recently were closed only seasonally; but they are now closed indefinitely. Closed Area II is located adjacent to the Hague (ICJ) line, and haddock from the Georges Bank stock are known to migrate across the ICJ line from Canada into this area during spring, and back into Canadian waters in the fall. Although spring distribution patterns may show higher densities of haddock within Closed Area II, seasonal migrations outside the closed area may limit its effectiveness.

The problems associated with using NEFSC research vessel survey data include the following:

1) low sampling intensity does not allow accurate assessment of the effectiveness of the closed area;

2) the closed areas encompass 6-9 different strata, making it necessary to post-stratify based on depth; and

3) variable recruitment and shifts in habitat use may confound the analysis.

Atlantic cod and yellowtail flounder were discussed as possible alternative species to consider. Cod appears not to migrate as much as haddock and may reveal additional information. Sea

scallops were also mentioned as a species which may give insight into the effectiveness of the closures. Spawning seasons were discussed as possible alternatives to long term closures. However, the short term payoff is lost once the area is reopened to fishermen.

Closing Comments

The desireability of close cooperation was noted at numerous points throughout the meeting. Specific areas mentioned included: data collection, particularly with respect to research vessel survey programs; assessments of transboundary stocks (now covered through the SAW and RAP processes); stock identification studies; and surveys to develop population estimates of marine mammals. Specific recommendations were also made that Canada and the U.S. should collaborate in the development of proposals for an ICES study group for lobsters and in efforts to improve the utility of NAFO from a scientific perspective.

Participants were in general agreement that future meetings should be held on alternate years, preferably on "neutral ground" away from home laboratories. With respect to structure, participants generally favored a mixture of overviews of research programs and more detailed examination of selected topics. In either case, participants drew attention to the need for controlling the amount of material presented, so as to leave adequate time for discussion. Also, the point was made that a different venue and/or broader participation from provincial, state or academic organizations might be more appropriate for some of the disciplines represented at the current meeting, e.g. Social Sciences. There seemed to be general agreement that everyone benefitted from exposure to other relevant research activities; and that in addition to the more formal interactions, the meetings were also valuable in bringing key players together for informal discussions. These considerations will be weighed in planning future meetings. Possible locations might include Bar Harbor (site of the 1993 meeting) or Boothbay Harbor, Maine; or perhaps Campobello Island.

Appendix 1.

13th Canada/US Scientific Discussions
St. Andrews, October 8-10

Final Agenda

October 8

09:00-09:30 **Welcome and Introduction** (J. Neilson and S. Clark, Co-Convenors)

09:30-12:00 **Theme Session I -- Fisheries Input Data: The Present and Future in Both Countries (Convenors -- C. Annand (Canada), S. Clark (US))**

1. Commercial Fishery Sampling and Statistics
   Discussion led by Greg Power (NMFS) and Chris Annand (DFO)

2. Joint Industry/Government Initiatives
   Discussion led by P. Hurley (DFO)

3. Research Vessel Surveys -- New Developments
   Discussion led by Mike Tork, Paul Kostovick (NMFS) and Joe Hunt (DFO)

13:00-17:00 **Theme Session II -- Distribution and Migration of Transboundary Resources in the Gulf of Maine Area: Areas for Joint Investigation (Convenors -- S. Gavaris (Canada), S. Murawski (US))**

1. Introduction : Identification of the importance of understanding distribution and migration relative to the Canada USA maritime boundary.

2. Comparison of Stock Status: Comparison of results from the recent USA and Canadian assessments for herring, cod, haddock and pollock where different "assessment units" are used.

3. Developments in the understanding of population structure, led by scientists responsible for the Canadian and USA assessments. This can be followed by contributions on recent work by others relevant to the topic.

*****A Reception will be held tonight at 1900 h, at a location TBA.*****

October 9

09:00-10:30 Review of Social Sciences Research Programs Within DFO and NMFS. (Leaders: L. Brander, E. Thunberg, T. Clay)

10:30-12:00 NAFO as a Forum for Fisheries Science: Strengths and Weaknesses. (Leaders: B. Atkinson, F. Serchuk)

13:00-15:30 **Theme Session III -- (October 9, 09:00 - 12:00 h) (Transboundary Resources Cont'd, Co-Convenors, E. Trippel (Canada) and D. Potter (USA)**

1. USA and Canadian stock assessment approaches for lobsters in the Gulf of Maine (P. Rago ((USA), D. Pezzack (USA))

2. Marine Mammal Investigations, particularly harbour porpoise (E. Trippel, W. Stobo).

3. Canada/US investigations on sharks (N. Kohler, R. O'Boyle, P. Hurley)

15:30-16:30 Discussion of the ECNASAP Project -- Main Recommendations from July 10-11 Workshop. (Leaders: R. O'Boyle, S. Clark)

October 10

09:00-12:00 **Theme Session IV -- Contributed Papers (Convenors: R. Brown, G. Melvin)**

1. Technological innovations in fisheries monitoring (H. Parker)*

2. Causes of the retrospective pattern in stock assessments (R. Mohn)

3. Trawling impact studies (C. Bourbonnais)

4. Closed areas (P. Rago)

5. Technological interactions in the groundfish fisheries of the Gulf of St. Lawrence (A. Sinclair)

6. Egg viability and offspring production in young Atlantic cod: implications for stock recruitment relationships. (E. Trippel)

Meeting Adjournment

* *Speaker was unavailable*

Appendix 2.

13th Canada/US Scientific Discussions
St. Andrews, October 8-10

Participants

Name	Affiliation
Chris Annand	Department of Fisheries and Oceans, Canada
Steve Clark	National Marine Fisheries Service, USA
Alan Sinclair	Department of Fisheries and Oceans, Canada
Stratis Gavaris	Department of Fisheries and Oceans, Canada
Steven Murawski	National Marine Fisheries Service, USA
Michel Audet	National Marine Fisheries Service, USA
Leo Brander	Department of Fisheries and Oceans, Canada
Bruce Atkinson	Department of Fisheries and Oceans, Canada
Joe Hunt	Department of Fisheries and Oceans, Canada
Katherine Sosebee	National Marine Fisheries Service, USA
Susan Wigley	National Marine Fisheries Service, USA
Jay Burnett	National Marine Fisheries Service, USA
Trish Clay	National Marine Fisheries Service, USA
Eric Thunberg	National Marine Fisheries Service, USA
Mike Tork	National Marine Fisheries Service, USA
David Potter	National Marine Fisheries Service, USA
Debra Palka	National Marine Fisheries Service, USA
Russell Brown	National Marine Fisheries Service, USA
Paul Kostovick	National Marine Fisheries Service, USA
Donald Clark	Department of Fisheries and Oceans, Canada
Bob Mohn	Department of Fisheries and Oceans, Canada
Peter Perley	Department of Fisheries and Oceans, Canada
Gary Melvin	Department of Fisheries and Oceans, Canada
Lou van Eeckhaute	Department of Fisheries and Oceans, Canada
Loretta O'Brien	National Marine Fisheries Service, USA
Bill Overholtz	National Marine Fisheries Service, USA
Peter Hurley	Department of Fisheries and Oceans, Canada
Wayne Stobo	Department of Fisheries and Oceans, Canada
Mike Strong	Department of Fisheries and Oceans, Canada
Fred Page	Department of Fisheries and Oceans, Canada
Nancy Kohler	National Marine Fisheries Service, USA
Lisa Natanson	National Marine Fisheries Service, USA
Ed Trippel	Department of Fisheries and Oceans, Canada
Maria Buzeta	Department of Fisheries and Oceans, Canada
Rob Stephenson	Department of Fisheries and Oceans, Canada

Name	Affiliation
Mike Power	Department of Fisheries and Oceans, Canada
Bob O'Boyle	Department of Fisheries and Oceans, Canada
Jim Gale	Department of Fisheries and Oceans, Canada
Paul Rago	National Marine Fisheries Service, USA
Joe Idoine	National Marine Fisheries Service, USA
Greg Power	National Marine Fisheries Service, USA
Steve Clark	National Marine Fisheries Service, USA
John Neilson	Department of Fisheries and Oceans, Canada